The principal geological problem, which it was hoped the expedition would settle, was whether the Omo Valley is a continuation of the great East African Rift Valley, in which Lake Rudolf lies. Unfortunately the circumstances which prevented Dr. Smith tracking the Nianam further towards its source are responsible for this question being left open. Dr. Smith, however, believes that the Omo is one of the head streams of the Juba, and does not flow into Lake Rudolf, as is generally believed from Borelli's work. If the altitudes given us are correct, the new view is impossible. Borelli descended the Omo to the level of 3450 feet: Bottego ascended the Juba to a height of over 4500 feet: the Omo cannot flow 1000 feet up hill into the Juba. Another alternative was once possible. We have previously suggested, from Dr. Smith's preliminary map, that "it is just possible that the Omo reaches this lake [Abaya] instead of Basso Narok [*i.e.*, Lake Rudolf]" [Gregory, "Great Rift Valley," p. 258]; but now Dr. Smith fixes the height of Lake Abaya as 3460 feet, so that the Omo is excluded from that goal. Hence, we are driven to the conclusion that the Omo must continue as the Nianam, and flow into Lake Rudolf, as Borelli believed; this conclusion is in agreement with the altitudes and with the trend of the country as shown by Dr. Smith's map.

Another point of interest to geologists is the evidence as to the existence of volcanic activity in this region; for Dr. Smith tells us that the Teleki volcano at the southern end of Lake Rudolf, in August 1895 "sent up clouds of smoke, and at night a great stream of glowing lava could be seen pouring from one of the craters" (p. 333). This information is especially interesting, as Mr. Neumann found no signs of activity there, and as the oft-asserted "Volcano Doenyo Ngai" now turns out not to be a true volcano.

In one respect Dr. Smith's information is strikingly different from that of Teleki and Höhnel. These explorers found the water of Lake Rudolf so brackish that they could hardly drink it, while that of Lake Stefanie was so salt that it was quite useless, and they could only stay on its shore owing to the existence of pools of rain-water. This was in 1888. But in 1895 Dr. Smith found the water of both lakes was quite fresh, in which he is confirmed by a very accurate observer, Mr. A. H. Neumann, for the northern end of Lake Rudolf. There can be no doubt that a remarkable change in the salinity of these lakes has taken place in only seven years; and the possibility of such changes must be borne in mind in considering the origin and relations of the African lake faunas. For example, it has been urged that the marine origin of the Tanganyika fauna is impossible, since there is no trace of marine influence in that of Lake Nyasa, through which the former, on the usual theory, must have passed. But Lake Stefanie reminds us that either a too rapid freshening of a lake, or a period of intense salinity, may obliterate the original fauna. Hence the complete absence of any marine types from the fauna of Nyasa is no proof that that of Tanganyika had not a marine origin. It should, however, be remarked that we are not expressing any acceptance of the view that the fauna of Tanganyika has any marine characters; but only that one of the arguments against that view is invalid.

The part of the book most open to criticism is that dealing with ethnography; but the facts mentioned show that the country traversed is of extreme interest. The author found some dwarf people about five feet high, and gives us a list of their words, although a few phrases would have been more useful; he describes some wells, which he attributes to the ancient Egyptians: and he met with Midgans, Tomal and "half-caste Boran," respecting each of which more detailed information is desirable. One quaint slip in this department is speaking of a "tamasho (*sic*) or equestrian exhibition" as though it were a Somali word instead of Hindustani for a "function." But one man cannot do everything; and now that the author has shown the way, we hope that other travellers will follow and collect further information regarding the many questions which the volume raises. For it is a great testimony to the interest of the country that Dr. Donaldson Smith's valuable book suggests as many problems as it solves.

J. W. G.

EXERCISES IN PHYSICS.

Problems and Questions in Physics. By C. P. Matthews and J. Shearer. Pp. vii+247. (London: Macmillan and Co., Ltd., 1897.)

THIS useful book contains more than thirteen hundred problems in the various branches of physics, and, from the point of view of degree work, covers the ground required for the London Matriculation and Intermediate Science Examinations, as well as part of that for the Final B.Sc. It is, however, intended for all students of elementary physics, including, therefore, students of engineering, and the peculiar needs of the latter have also been provided for.

The authors begin with an introduction, which, as they explain, is intended not only to be read, but continually referred to, and contains short sections on physical measurement in general, units, vectors, the expression of physical relations by curves, averages, and approximations. A few examples are added on graphic methods, as well as a list of units and physical constants for use in the problems. Next follow the problems themselves; and the book ends with a set of four-figure mathematical tables, the solutions to the problems, and a rather meagre index.

In a work designed for students of both engineering and physics, one naturally looks first to see what is said on the vexed question of the unit of force. We congratulate the authors on the line they have here taken. As they explain in their preface,

> "Many of the students who will use these problems are pursuing engineering courses. In such case, they must of necessity use engineering units. The aim has been not so much to train them in the use of these units—an abundance of this training comes to them during their course—but to bring out the relation of the so-called practical and gravitational units to the C.G.S. units of physics."

The C.G.S. and foot-pound-second systems are first defined, and the superfluous character of the latter tacitly assumed. This is shown by the fact that, after its definition has been given, the word poundal does not again occur. The authors then explain that pound and kilogramme are used by engineers as names for units of

© 1897 Nature Publishing Group

force, and the two corresponding gravitational systems are well illustrated by problems introduced, throughout the mechanics section, among those on C.G.S. measurements.

This takes us as far as is at present, perhaps, possible in the direction of a compromise to which many teachers of physics are now looking forward—the recognition, namely, of two distinct systems of measurements only; one the C.G.S. with its derived practical system, for scientific and electrical purposes, the other the system used by engineers, and based on the units of length, time, and *force*.

Among other noteworthy features is a good set of problems on dynamos and alternating currents, another on wave and harmonic motions in connection with sound, and a third on gravitational potential in the section on work and energy. Less commendable, however, is the reference to water-levels in connection with electrical potentials. The most perfect "water analogy," and the one which, in our experience, appeals most directly to students, is that in which conductors are represented by water-filled cavities in a large block of india-rubber; it affords, indeed, almost the only means of enabling the average beginner to realise how the potential of a body or of a point in space may be altered by altering the charge on another body at a distance.

It is a pity that those problems which admit of solutions are not all supplied with them. Many are of the nature of examination questions, requiring long answers in words, and to these, naturally, no answers are given; but of the rest, not more than about three-fourths are solved.

We have noticed the following slips. The answers to Nos. 251, 759, 775, 776, 837 are either wholly or partially wrong; in No. 607 the water-worth of the dish should be given; and the headings to pp. 204 and 221 want altering. These are, however, small blemishes on an otherwise very useful work. A. P. C.

COSMIC ETHICS.

Cosmic Ethics; or, the Mathematical Theory of Evolution. By W. Cave Thomas. Pp. xxii + 296. (London: Smith, Elder, and Co., 1896.)

IN styling his book "Cosmic Ethics," Mr. Cave Thomas means to imply that not only in morals as a department of "the wider hygiene," but throughout the universe, there is but one law of rightness, that of balance, proportion, or the mean. By "mathematical evolution" he desires to signify that evolution is "the becoming of the proportioned," its goal being "the at-mean-ment of nature."

Starting from the admitted applicability of the idea of quantity throughout the concrete world, and from the progress which the sciences undoubtedly make when measurement or quantitative formulæ can be used in them, Mr. Thomas advances to an apotheosis of the average, and offers principia of the science of proportion and applications of quantification throughout the whole range of human knowledge. By somewhat elementary numerical formulæ we can determine the beau-idéal in the arts, attain to a quantitative ethic, discover that a man ought to drink neither too much nor too little, that his morning tub should not vary much in temperature from that of the human body, that the combination of great athletic and great intellectual effort leads to a break-down, and that technical and specialist education is inferior to general education.

Of the principia we may quote as an instance: "*The mean of fraction* is $\frac{1}{2}$; it is the fraction which is equally indifferent to the two extreme fractional limits of $\frac{1}{1}$ and $\frac{1}{0}$." (!) Of the exemplifications of the formulæ, we may point out that they are purely arbitrary. We ought to aim, we are told, at not diverging from the average, which is the ideal, to any extent which carries us beyond the middle third of our scale. Why not the middle fifth or seventh? There is no attempt to point out how the qualitative kind to which any particular scale is applicable is determined, and this despite of the fact that in a quotation which he makes from Reynolds—one of a constantly recurring set of quotations—that point is definitely raised.

Mr. Thomas accepts the Darwinian theory, though how the importance which that theory ascribes to "accidental variations" from type, can be reconciled with his own views as they stand, it is difficult to see. In fact, as they are here put before the reader, Mr. Thomas's doctrines will not allow of being harmonised into an intelligible system. This is the more to be regretted, as there is no doubt that an adequate elucidation of the theory of quantity, number, and measurement, would be of very great service to applied science. Nay, it is perhaps not too much to say that from the Galton system of composite photography, and from the statistical results of anthropometry, to which the author refers, conclusions of considerable value for art may be drawn. But they are not those drawn by Mr. Cave Thomas, nor to be drawn by his methods; though his considerable judgment in art and his grasp of the distinction between the organic fitness of an object for its purpose and its appositeness to human taste, make this department of his investigations the least unpromising.

His quotation of the headings of the chapters in Aristotle suggests the suspicion that Mr. Thomas has not studied that author in the Greek. Otherwise the attribution to him of a system of quantitative ethics would be, despite of the great authorities for that view, less pardonable than it is. Yet to the Greeks Mr. Thomas has chosen to go in his quasi-Pythagorean glorification of quantity. H. W. B.

OUR BOOK SHELF.

The Flora of the Alps. By Alfred W. Bennett, M.A., B.Sc., F.L.S. 2 vols., with 120 coloured plates. Pp. xxii + 165; vi + 223. (London: J. C. Nimmo, 1896.)

THE Alpine wanderer will not be very grateful to Mr. Bennett and his publishers for this new "Flora of the Alps." The net is spread widely; for, in addition to the whole Swiss flora, there are included here plants from adjacent mountain districts, and also the Pyrenees. The result is a rather cumbrous affair, and yet unsatisfying in detail. The species of each genus are enumerated with very short and sometimes rather inadequate characters, so that the identifying of specimens is not always as easy as it might be. That the book is arranged according to the system of Bentham and Hooker we may regard as a welcome innovation in Alpine floras, which have been too long wedded to the irritating Linnæan system. The

© 1897 Nature Publishing Group